



[Billing Code 6355-01-P]

CONSUMER PRODUCT SAFETY COMMISSION

[CPSC Docket No. CPSC-2014-0009]

Carbon Monoxide/Combustion Sensor Forum and Request for Information

AGENCY: Consumer Product Safety Commission.

ACTION: Announcement of meeting and request for information.

SUMMARY: The Consumer Product Safety Commission (CPSC, Commission, or we) is announcing that the CPSC intends to hold a forum on carbon monoxide/combustion sensors. Through this announcement, we are also issuing a Request for Information (RFI) seeking information on the availability of sensors that are capable of: (1) operating within the flue passageways of a gas appliance or similar environment; (2) directly or indirectly monitoring carbon monoxide levels or other gases or environmental conditions associated with the production of dangerous levels of carbon monoxide; and (3) providing a shutdown or other preemptive signal in response to dangerous levels of carbon monoxide. We invite interested parties to provide information responsive to the RFI and to attend and participate in the forum and to submit comments responsive to the forum agenda.

DATES: The forum will be held from 9:00 a.m. to 4:00 p.m. on June 3, 2014.

Individuals interested in serving on panels at the forum should register by May 9, 2014; all other individuals who wish to attend the forum should register by May 23, 2014.

Written comments will be received until July 7, 2014.

ADDRESSES: The forum will be held at the CPSC's National Product Testing and Evaluation Center, 5 Research Place, Rockville, MD 20850. There is no charge to attend

the forum. Persons interested in serving on a panel or attending the forum should register online at: <http://www.cpsc.gov/meetingsignup.html>, and click on the link titled, “Carbon Monoxide/Combustion Sensor Forum.” For those who are unable to attend, the forum will also be webcast.

You may submit written comments, identified by Docket No. CPSC-2014-0009, by any of the following methods:

Electronic Submissions

Submit electronic comments in the following way:

Federal eRulemaking Portal: <http://www.regulations.gov>. Follow the instructions for submitting comments. The Commission does not accept comments submitted by electronic mail (e-mail), except through www.regulations.gov. The Commission encourages you to submit electronic comments by using the Federal eRulemaking Portal, as described above.

Written Submissions

Submit written comments in the following way:

Mail/Hand delivery/Courier, preferably in five copies, to: Office of the Secretary, Consumer Product Safety Commission, Room 820, 4330 East West Highway, Bethesda, MD 20814; telephone (301) 504-7923.

Instructions: All submissions received must include the agency name and docket number for this notice. All comments received may be posted without change, including any personal identifiers, contact information, or other personal information provided, to <http://www.regulations.gov>. Do not submit confidential business information, trade

secret information, or other sensitive or protected information electronically. Such information should be submitted in writing.

Docket: For access to the docket to read background documents or comments received, go to: <http://www.regulations.gov> and insert the docket number CPSC-2014-0009 into the “Search” box, and follow the prompts.

FOR FURTHER INFORMATION CONTACT: Ronald Jordan, Division of Combustion and Fire Sciences, Directorate for Engineering Sciences, 5 Research Place, Rockville, MD 20850, telephone 301-987-2219, e-mail: rjordan@cpsc.gov.

SUPPLEMENTARY INFORMATION:

I. Background

a. Hazards Associated with Vented Gas Heating Appliances

Vented gas heating appliances provide comfort heat to consumers in single- and multifamily dwellings, as well as in schools, motels/hotels, and nursing homes; burn natural gas or propane as a fuel; and exhaust the by-products of combustion from the appliance to the outdoors through a vent system or chimney. Vented gas heating appliances include gas furnaces, boilers, wall furnaces, and floor furnaces. When these appliances experience certain failure modes or conditions, dangerous levels of carbon monoxide (CO) can be produced.

CO is a by-product of the incomplete combustion of hydrocarbon fuels, such as natural gas, propane and oil. Incomplete combustion in a vented gas heating appliance can occur when too much fuel or inadequate air for combustion are supplied to the burner, or when the burner flame temperature is reduced below the ignition temperature of the fuel. When the flue passageways and venting systems of appliances are intact and

properly installed and maintained, CO that results from incomplete combustion is safely vented to the outdoors. However, when a compromised flue passageway or venting system (*e.g.*, a separated flue, a disconnected vent, or a hole in a vent) creates a leakage path, CO can enter the living space and present a hazard to consumers.

b. Incident Data

We analyzed death certificate data compiled by the National Center for Health Statistics (NCHS) and death certificates purchased by the CPSC from the 50 states, the District of Columbia, and New York City to estimate the number of CO poisoning deaths associated with vented gas heating appliances. According to this analysis, for the 12-year period from 1999 to 2010, there were a total estimated 369 non-fire CO poisoning deaths associated with central gas furnaces/boilers, wall furnaces, and floor furnaces. This analysis also revealed that for the years 2008 through 2010, an annual estimated 25 non-fire CO poisoning deaths were associated with these types of appliances.

CPSC staff conducted a review of In-Depth Investigations (IDIs) of non-fire-related CO incidents associated with gas furnaces and boilers:

http://www.cpsc.gov/PageFiles/130036/Updated_IDI_review_CO_and_modern_furnaces_and_boilers.pdf. The IDI review covered the years 2002 through 2009, and revealed 83 incidents associated with carbon monoxide poisoning and gas furnaces and boilers that were determined to have been manufactured after 1987. In 73 of the 83 incidents, the investigating authorities were able to identify the failure mode of the furnace or boiler. Thirty-one of the incidents involved the breach, disconnection, or blockage of the vent, chimney, or heat exchanger. In three of the incidents, reports identified the failure mode as improper venting; and in an additional three incidents, the failure mode was

depressurization or back drafting. An additional 36 incidents were associated with miscellaneous or multiple failure modes. There were 44 fatalities associated with these 83 CO poisoning incidents.

c. CPSC Staff's Activities Regarding Sensor Testing

Despite safety improvements made to the gas appliance voluntary standards in the 1980s, the governing standards for gas-fired central furnaces (ANSI Z21.47), gas-fired boilers (ANSI Z21.13), and gas-fired wall and floor furnaces (ANSI Z21.86) do not protect against many of the failure modes or conditions observed to cause or contribute to CO exposure incidents.

1. CPSC's Activities with Voluntary Standards Organizations

For more than a decade, CPSC staff has worked with voluntary standard organizations to encourage including CO shutoff requirements in voluntary standards. In 2000, to address CO poisoning risks, CPSC staff recommended that the governing voluntary standard group, the ANSI Z21.47 Central Furnace Subcommittee, add a provision to the ANSI furnace standard that would require a means to prevent furnaces from producing concentrations of CO in excess of 400 parts per million (ppm) (the carbon monoxide emission limit set forth in the voluntary standard for gas furnaces, ANSI Z21.47) or cause the shutdown of furnaces in response to those CO levels.

http://www.cpsc.gov/PageFiles/106498/Letter_ANSI_Z21.47_COemissions_furnace2_to_5_CO_shutoff_proposal.pdf.

In 2001, CPSC staff began investigating combustion gas sensing technologies that might be used to detect CO in appliance flue passageways and provide a shutoff or some other preemptive response to dangerous levels of CO. CPSC staff tested sensor

technologies to demonstrate the ability of CO/combustion sensors to provide detection and shutdown response to CO concentrations in excess of 400 ppm. At the conclusion of this testing, CPSC staff determined that existing CO sensor technology could be used to detect CO concentrations in excess of 400 ppm in vented gas heating appliances and shut down the appliance.

http://www.cpsc.gov/PageFiles/98232/Furnace_combustion_sensor_test_results.pdf.

CPSC staff provided these test results to the Z21.47 furnace subcommittee to support CPSC staff's earlier proposal that the furnace standard be revised to require that vented gas heating appliances be required to detect dangerous levels of CO and shut down if high levels of CO are detected.

The Z21.47 subcommittee referred CPSC's CO shutoff proposal to the ANSI Z21/83 Technical Committee (Technical Committee), which in 2002, established the ANSI Z21/83 Ad Hoc Working Group for CO Combustion Sensors (AHWG). AHWG was tasked with developing test and work plans to evaluate the feasibility of using gas and combustion sensing technologies for CO shutoff of furnaces and other vented gas heating appliances and, if warranted, begin development of an appropriate standard.

CPSC staff worked with the AHWG from 2002 through 2004 to complete the test criterion. The Technical Committee met in September 2005, and decided not to pursue CO/combustion sensor testing, citing concerns that there were no commercially available sensors that were:

- (1) durable enough to withstand the furnace operating environment, or
- (2) had the expected life span (*e.g.*, 15 years) of a furnace.

In response to the Technical Committee's decision not to pursue CO sensor testing, CPSC staff conducted a test program from 2007 through 2008 to evaluate the durability and longevity of sensors operating in a gas furnace environment.

http://www.cpsc.gov/PageFiles/129834/CO_sensor_durability_and_longevity_testing.pdf

The purpose of the test program was to address the concerns about sensor durability and longevity raised by the Technical Committee at their 2005 meeting. Therefore, the testing only included those portions of the test criteria developed by the AHWG relevant to durability and longevity. The test results demonstrated the availability of chemical sensors capable of withstanding the harsh operating environment of a furnace and potentially surviving throughout the life span of the furnace. Based on the results of this testing, CPSC staff concluded that the inclusion of a CO shutoff requirement in the voluntary standard was technologically feasible. CPSC staff shared the report on the test results with the Technical Committee, as well as the Technical Advisory Groups (TAG) for gas furnaces (ANSI Z21.47 TAG) and gas boilers (ANSI Z21.13 TAG).

2. Gas Technology Institute Report

In 2011, the Gas Technology Institute (GTI) (a research, development and training organization that develops technology-based solutions in the natural gas and energy fields for industry, government and consumers) prepared a report titled, "Technical Feasibility Study Carbon Monoxide Sensing Safety Systems for Appliances" (GTI Report).

http://www.ari.org/App_Content/ahri/files/RESEARCH/Technical%20Results/AHRI-8001%20Final%20Report.pdf.

The purpose of the GTI Report was to “establish a technical baseline for considering the practical feasibility of integrating CO sensors into gas appliances, and to identify critical areas needing further development or research.” According to the GTI Report, there are several factors that prevent CO sensors from functioning properly when used in a gas-fired appliance:

- the temperature and humidity conditions in the flue or combustion chamber;
- the presence of contaminants in the flue or combustion chamber; and
- the short life span of CO sensors (6 years) when compared to the life span of gas-fired appliances (20 years).

The GTI Report concluded that “extensive research is required before current designs of CO sensors would be able to operate in the combustion chamber or the flue of a gas-fired appliance for a length of time for use as a safety or combustion control device.” This conclusion is inconsistent with the results of CPSC staff’s sensor testing that in CPSC staff’s view demonstrated the availability of chemical sensors capable of withstanding the harsh operating environment of a furnace and potentially surviving throughout the life span of the furnace.

II. Request for Information

a. Purpose

We request information to help CPSC staff gain a broader understanding of the availability and the state of the art of all sensor technologies that are capable of being used within the heat exchangers, flue passageways, and/or vent systems of vented gas heating appliances to shut down the appliance in response to dangerous levels of CO in

these areas of the appliance or upon detection of incomplete combustion conditions that can lead to the production of dangerous levels of CO.

CPSC is interested in information regarding sensor technologies that:

- determine CO concentration by directly measuring CO levels;
- determine CO concentration indirectly by measuring other combustion gases, such as carbon dioxide, oxygen, or unburned natural gas or liquefied petroleum gas (LP-gas), or environmental conditions, such as temperature, humidity, or displacement; and
- detect incomplete combustion conditions that could result in the production of dangerous levels of CO.

We are also interested in sensor technologies at various stages of product life-cycle development, including:

- full-scale production models
- prototypes that are less than 2 years from full-scale production; and
- prototypes between two and 5 years from full-scale production.

CPSC staff is aware that CO/combustion sensing technology is already in use with vented gas heating appliances in Japan and believes that actions such as including this technology in vented gas heating appliances in the United States could help reduce the risks of death and injury associated with CO exposure from these products. CPSC staff would like to learn more about Japan's experience with this technology, and we expect that responses to the request for information will provide helpful information in this regard. CPSC will use information gained from responses to the RFI and from the

forum to determine future work to reduce the risks of death and injury associated with CO exposure.

b. Information Requested

In preparing information or comments for the RFI and for consideration at the forum, commenters should be aware of the typical operating environment of a vented gas appliance and some basic operating requirements of a CO/combustion sensor cited in the table below. Response range and maximum exposure limits for sensors that detect other target gases or environmental conditions will vary.

Criteria	Range
Temperature	-40 to 500 degrees F
Humidity	0 to 100%
CO Sensor Response Range	0 to 400 ppm
Maximum CO Sensor Exposure	3000 ppm
Lifespan	5, 10,15, & 20 years
Accuracy	5%
Supply voltage to sensor	0 to 10 VDC; 0 to 24 VAC

CPSC staff is particularly interested in receiving the following information:

- Detailed descriptions of gas or environmental condition sensors that the commenter currently manufactures or has developed or worked with, and that are used or capable of being used for an in-flue application, or similar environment, to shut off vented gas heating appliances reliably when dangerous levels of CO or incomplete combustion are detected.

- Data from completed testing that demonstrates the capability of the sensors to operate within the flue passageways of vented gas heating appliances, or similar environments, and the expected life of sensors installed in these appliances or similar environments.
- Quantitative Accelerated Life Testing (QALT) data that demonstrate the sensors' ability to perform reliably when installed in gas heating appliances; and/or
- Mean Time Between Failure (MTBF) data and other sensor life data at normal and overstress use conditions.
- Detailed descriptions of prototype gas or environmental condition sensors that the commenter has developed, worked with, or expects to be ready for full-scale production within 1 to 2 years and that are capable of being used for an in-flue application, or similar environment, to shut off vented gas heating appliances reliably when dangerous levels of CO or incomplete combustion are detected.
 - Preliminary or intermediate data of completed testing or testing the commenter expects to complete within the next 1 to 2 years that demonstrates the capability of the sensors to operate within the flue passageways of vented gas heating appliances, or similar environments, and the expected life of sensors installed in these appliances or similar environments should be provided.
 - QALT data that demonstrate the sensors' ability to perform reliably when installed in vented gas heating appliances; and/or

- MTBF data and other sensor life data at normal and overstress use conditions.
- Plans for testing or development that the commenter intends to pursue during the next 1 to 2 years that may demonstrate that a gas or environmental condition sensor is capable of being used for an in-flue application, or similar environment, to shut off gas heating appliances reliably when dangerous levels of CO or incomplete combustion are detected.
 - Plans to conduct QALT to substantiate the sensor's ability to perform properly when installed in a vented gas heating appliance, or similar environment, and to measure MTBF and other sensor life data at normal and overstress conditions.
- Past, present, or future (*i.e.*, within the next 1 to 2 years) efforts to market the above-described gas or environmental condition sensors to the gas appliance industry or other industries with similar operating environments (*e.g.*, automotive industry).
- The current or estimated wholesale cost of gas or environmental condition sensors supplied to an appliance manufacturer or an end user with a similar operating environment for full-scale production (if available).

III. Carbon Monoxide/Combustion Sensor Forum

The forum will take place on June 3, 2014. The forum will be comprised of a plenary session and technological solutions sessions (detailed in section III. b.) The first session will discuss hazard patterns that lead to CO exposure, available mechanisms that

exist to address the hazards, and efforts over the years to address the hazards. This session will serve as background and provide the context for the afternoon sessions.

The subsequent sessions will focus on possible technological solutions to address the hazard, barriers to further development of technologies for an in-flue shutoff application (*i.e.*, a sensor located within the heat exchanger or flue passageways of a gas heating appliance that will shut off the appliance when elevated levels of CO are detected), and cooperation among stakeholders. Each session will provide interested parties the opportunity to present their research, developments, or expert knowledge on the topic area. Each session will conclude with time for open discussion and questions and answers led by CPSC staff moderators.

a. What Do We Hope the Forum Will Accomplish?

Current voluntary standards do not address all failure mechanisms that are known to result in CO exposure from vented gas heating appliances. CPSC staff successfully demonstrated the concept of using CO shutoff sensors in a gas furnace in 2001 and 2004 (http://www.cpsc.gov/PageFiles/98232/Furnace_combustion_sensor_test_results.pdf; http://www.cpsc.gov/PageFiles/103897/Combustion_sensor_test_results.pdf), and the durability of some sensors to operate in the harsh environment of a gas furnace, possibly for the life of the appliance in 2012 (http://www.cpsc.gov/PageFiles/129834/CO_sensor_durability_and_longevity_testing.pdf).

Based on the results of this testing, CPSC staff believes that CO and other gas/environmental condition sensors are technically feasible solutions that could address risks and related deaths and injuries associated with vented gas heating appliances.

However, CPSC staff would like to obtain additional information to build a broader understanding of sensor technologies currently available and under development, as well as any barriers to using these technologies in a vented gas heating appliance. CPSC staff invites sensor manufacturers, appliance manufacturers, standards organization representatives, consumer groups, and other stakeholders to participate in the Carbon Monoxide/Combustion Sensor Forum.

The goals of the forum are:

1. To inform forum attendees of the hazards identified by CPSC staff and efforts made so far to address the hazards of CO poisoning from vented gas heating appliances;
2. To gain a broader understanding of the scope, state of the art, and availability of sensor technologies being used in, or capable of being used in, an in-flue shut off application or similar harsh environments;
3. To gain a better understanding of the scope, state of development, and availability of prototype gas or combustion sensors that may be commercially available within 1 to 5 years and that are capable of being used in an in-flue shut off application or similar harsh environments;
4. To gain a better understanding of potential barriers to further development and commercialization of sensors used in, or capable of being used in, an in-flue shut off application or similar harsh environments;
5. To gain a better understanding of potential failure modes likely to be encountered in using gas sensors in an in-flue shut off application or similar harsh environments and strategies to mitigate those failure modes;

6. To gain a better understanding of the expected life of sensors used in an in-flue shut off application or similar harsh environments; and
7. To encourage development of technological solutions to the stated problem among forum attendees and to foster cooperative relationships among forum attendees to achieve those solutions.

b. What Topics Will Be Addressed at the Forum?

The forum will focus on various technological means of reducing the risk of CO exposure from vented gas heating appliances under a variety of conditions. We recommend that all potential panelists consider this general theme when preparing for the forum. We list suggested topics below. CPSC staff reserves the right to include or decline topics based on whether staff believes the topics will aid the forum objectives or fit within the time constraints of a 1-day event.

Forum Topic Areas

1. CPSC and stakeholder efforts to address CO hazards resulting from malfunctioning gas heating appliances.
 - Suggested topics:
 - results of testing of CO sensing technology for functionality, longevity, and durability;
 - exploration of CO sensor testing being performed by gas heating appliance manufacturers;
 - U.S. and international voluntary standard development organization activity addressing CO exposure hazards.

2. Use of sensor technology for safe shutdown of a gas heating appliance when incomplete combustion or dangerous levels of CO are detected.

- Suggested topics:
 - operating environment of sensors, types of gases and environmental parameters to monitor;
 - operating ranges and expected life of sensors;
 - scope, state of the art, and availability of sensor technologies currently being used to shut off gas heating appliances when incomplete combustion or dangerous levels of CO are detected or that are used in similar, harsh environments;
 - scope, state of the art, and availability of prototype gas sensors that may be commercially available for this purpose within 1 to 5 years; barriers to development and commercialization of sensors capable of being used in the in-flue shut off application or similar harsh environments;
 - potential cooperative relationships to bring existing technologies to market and further develop near term technologies.

We may combine, expand, or eliminate panel sessions depending on the level of interest. We will announce the final agenda on the CPSC website by May 28, 2014.

c. Details Regarding the Forum

1. When and Where Will the Forum Be Held?

The forum will be held from 9:00 a.m. to 4:00 p.m. on June 3, 2014, at the CPSC's National Product Testing and Evaluation Center, 5 Research Place, Rockville,

MD 20850. The forum will also be available through a webcast, but viewers will not be able to interact with the panelists.

2. How Do You Register for the Forum?

Panelists. If you would like to be considered as a panel member for a specific topic or topics at the forum, you should register on or before May 9, 2014. (See the **ADDRESSES** section of this document for the website link and instructions on where to register.) We ask that you indicate the panel or panels on which you would like to serve and each topic for which you wish to be considered. We ask that each potential panelist submit a brief (less than 200 word) abstract of the panelist's area of expertise and proposed topic, and a draft presentation or outline at the time of registration to Mr. Ronald Jordan, Division of Combustion and Fire Sciences, Directorate for Engineering Sciences, rjordan@cpsc.gov.

Although we will make an effort to accommodate all persons who wish to be panelists, we expect to limit each panel session to no more than five panelists. We will select panelists based on considerations such as the individual's demonstrated familiarity or expertise with the topic to be discussed, the practical utility of the information to be presented, and the individual's viewpoint, expertise, or ability to represent certain interests (such as appliance manufacturers, sensor manufacturers, consumer organizations, and standards organizations). We recommend that individuals and organizations with common interests consolidate or coordinate their presentations.

For the panel discussion focusing on technological solutions, CPSC staff is seeking sensor manufacturing representatives, appliance manufacturing representatives (with demonstrated experience working with sensors in this application), and regulatory

or standards development organization representatives (who have worked on or developed standards for sensor or other similar technologies for this or similar applications).

We will notify selected panelists on or before May 23, 2014. If you are selected as a panelist and want to make copies of your presentation or other handouts available, you should bring copies for dissemination to the forum. Please inform Mr. Ronald Jordan, rjordan@cpsc.gov, 301-987-2219, if you need any special equipment to make a presentation.

Other participants. If you wish to attend and participate in the forum but do not wish to be a panelist, you should register on or before May 23, 2014, and identify your affiliation. Every effort will be made to accommodate each person's request; however, we may need to limit registration to meet the occupant capacity of our meeting room.

If you need special accommodations because of a disability, please contact Mr. Ronald Jordan, rjordan@cpsc.gov, 301-987-2219, at least 10 business days before the forum.

The forum will be available through a webcast, but you will not be able to interact with the panelists. You do not need to register for the webcast. The forum will also be taped and made available for viewing on the CPSC website.

Written comments. If you wish to submit written comments, you may do so before or after the forum by any of the methods stated in the **ADDRESSES** portion of this notice. These comments will be accepted until July 7, 2014, and should be restricted to topics covered by the forum, as described in this Announcement.

3. What Will Be the Format of the Forum?

The forum will open with a plenary session that includes a brief overview of the Commission's past activities addressing CO exposure resulting from malfunctioning or improperly installed/maintained gas heating appliances. Following that, a series of panels will address one or more of the topics listed above, depending on registrations. Panel sessions are expected to consist of stakeholders and members of the public and will be moderated by CPSC staff. We expect potential panelists to speak for no more than 10 minutes each about their topic area. At the conclusion of each of the panel's presentations, there will be a question, answer, and discussion session among the panelists and the audience, centering on the topics discussed by the panelists. Each panel session is expected to last approximately 1 hour and 45 minutes.

All attendees will be given the opportunity to ask questions and make comments during the question, answer and discussion session following each panel.

4. What Happens if No One Registers for the Forum?

If no one registers for the forum, we will cancel the forum. If we decide to cancel the forum for this or any other reason, we will post a cancellation notice on the registration Web page for the forum and send an e-mail to all registered participants who provide their e-mail address when they register. If the forum is cancelled, written comments that are submitted as set forth in this Announcement will be accepted.

Dated: April 9, 2014.

Todd A. Stevenson,
Secretariat, Consumer Product Safety Commission.

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